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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,216	06/19/2001	Jen Kuang Fang	4459-050	9853

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EXAMINER

PAREKH, NITIN

ART UNIT PAPER NUMBER

2811

DATE MAILED: 03/19/2003

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/883,216

Applicant(s)

FANG ET AL.

Examiner

Nitin Parekh

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 January 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) 5 and 6 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mathew (US Pat. 4922322) in view of Li et al (US Pat. 6312830).

Regarding claim 1, Mathew discloses a method for forming a semiconductor device having a bump electrode (19 in Fig. 4 and 5), the method comprising:

- providing an aluminum contact pad (11 in Fig. 1-5) on a substrate (10 in Fig. 1-5), the pad being exposed on a region comprising a field oxide/dielectric isolation layer (10 in Fig. 1-5) of the substrate
- forming an aluminum layer (14a in Fig. 1- 4) on the field oxide/dielectric isolation layer and the aluminum pad
- forming a nickel-vanadium layer (15 in Fig. 1- 4) on the aluminum layer
- forming a gold layer (16 in Fig. 1- 4) on the nickel-vanadium layer

Art Unit: 2811

- selectively forming a gold bump (19 in Fig. 1- 4; Col. 3, line 32) on the gold layer at a location corresponding to the aluminum pad, and
- etching the aluminum, nickel-vanadium and copper layers (Fig. 5; Col. 3, line 47- Col. 4, line 5) using gold bump as a mask

(Fig. 1-5; Col. 3, line 5- Col. 4, line 5).

Mathew fails to specify providing the contact pad such that the pad is exposed through a dielectric layer and forming a titanium layer on the nickel-vanadium layer.

Li et al teach providing the aluminum pad on the substrate such that the pad is exposed through a dielectric/passivation layer (45/50 and 200/220 in Fig. 1a-c and 4b respectively) to provide the desired insulation and passivation (Col. 2, line 55; Col. 4, line 2).

Li et al further teach forming an under bump metallurgy (UBM) structure comprising a variety of configurations including a three layer structure having layers A, B and C, the layer A being adjacent to the pad and being formed on a non-refractory metal and the second and third layers (B and C) are formed of refractory metals such as titanium, titanium nitride, etc. (Col. 1, line 29- 40) to improve the wetting/adhesion and diffusion barrier for the UBM structure (Col. 3, line 35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the steps of providing the aluminum pad on

Art Unit: 2811

the substrate such that the pad is exposed through a dielectric layer and forming a titanium layer on the nickel-vanadium layer as taught by Li et al so that the wetting/adhesion, diffusion barrier and reliability of the UBM structure can be improved in Mathew's method.

3. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathew (US Pat. 4922322) and Li et al (US Pat. 6312830), and further in view of Crafts et al (US Pat. 5492235).

Regarding claim 2, Mathew and Li et al teach substantially the entire method as applied to the claim 1 above, including the step of forming the titanium layer but fail to specify performing a step of cleaning of the titanium layer.

Crafts et al teach performing a step of cleaning/etching the UBM layers such as titanium using a cleaning medium/solution comprising hydrochloric acid/HCl (Col. 5, line 45-50).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate a step of cleaning the titanium layer as taught by Crafts et al so that the wetting/adhesion and reliability of the UBM structure can be improved in Mathew's method.

Art Unit: 2811

Regarding claim 3, Mathew and Li et al teach substantially the entire method as applied to the claims 1 and 2 above, including the step of forming the titanium layer but fail to specify performing a step of treating the titanium layer with a cleaning medium.

Crafts et al teach performing a step of cleaning/treating the UBM layers such as titanium using a cleaning medium/solution comprising hydrochloric acid/HCl (Col. 5, line 45-50).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate a step of treating the titanium layer with a cleaning medium as taught by Crafts et al so that the wetting/adhesion and reliability of the UBM structure can be improved in Mathew's method.

Regarding claim 4, Mathew and Li et al teach substantially the entire method as applied to the claims 1-3 above, including the step of forming the titanium layer but fail to specify performing a step of cleaning of the titanium layer using a HCl cleaning medium.

Crafts et al teach performing a step of cleaning/etching the UBM layers such as titanium using a cleaning medium/solution comprising hydrochloric acid/HCl (Col. 5, line 45-50).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate a step of cleaning the titanium layer using a HCl cleaning medium as taught by Crafts et al so that the wetting/adhesion and reliability of the UBM structure can be improved in Mathew's method.

Art Unit: 2811

Response to Arguments

4. Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 703-305-3410. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.

Nitin Parekh

NP
03-14-03

Steve Loh